PATENT
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Applicants:	Peter HEIN et al.
Int'l Application No.:	PCT/DE03/01666
Application No.:	**NEW APPLICATION**
Filed:	December 7, 2004
For:	COMPUTER TOMOGRAPHY UNIT WITH A DATA RECORDING SYSTEM

LETTER

U.S. Patent and Trademark Office   December 7, 2004
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Customer Window - Mail Stop PCT
Crystal Plaza Two, Lobby, Room 1B03
Arlington, VA 22202

Sir:

Amended sheets are attached hereto (which correspond to Article 34 amendments or to

claims attached to the International Preliminary Examination Report), as required by 35 U.S.C.

§ 371(c)(3). The Article 34 amended sheets are incorporated in the included substitute

specification and Preliminary Amendment.

Respectfully submitted,

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Patent Claims

1.   A computer tomography unit having an X-ray beam
source (1) and having a radiation detector (4) which
has a number of detector elements (6a-6x), having a
data acquisition system (10) for reading the electrical
signals which are produced by the detector elements
(6a-6x) and for processing them to form raw data, and
having an image computer (12) which is arranged
downstream from the data acquisition system (10) and to
which the raw data can be supplied via a data
transmission path (11),
characterized by
an evaluation device (18) which is designed for
automatic assessment of the quality of the radiation
detector (4) and, in addition, for automated assessment
of the quality of the data acquisition system (10)
and/or of the data transmission path (11), wherein the
evaluation device (18) can carry out the following
steps:
a)   initiation of at least one measurement for
      production of raw data with the X-ray beam source
      (1) switched off,
b)   using the raw data, calculation of at least one
      value of a signal offset of the radiation detector
      (4),
c)   driving of a display device (20) in order to
      display an evaluation result in which the
      calculated value is included.

2.   A computer tomography unit having an X-ray beam
source (1) and having a radiation detector (4) which
has a number of detector elements (6a-6x), having a
data acquisition system (10) for reading the electrical
signals which are produced by the detector elements
(6a-6x) and for processing them to form raw data, and
having an image computer (12) which is arranged

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downstream from the data acquisition system (10) and to
which the raw data can be supplied via a data
transmission path (11),
characterized by

5   an evaluation device (18) which is designed for
automatic assessment of the quality of the radiation
detector (4) and, in addition, for automated assessment

of the quality of the data acquisition system (10) and/or of the data transmission path (11), wherein the evaluation device (18) can carry out the following steps:

5 a)   initiation of a number of measurements for production of raw data, in which case it is possible to automatically change the drive or setting of the X-ray beam source (1) between at least two measurements,

10 b)   using the raw data, calculation of at least one value of at least one parameter which allows a quality statement about the radiation detector (4),

    c)   driving of a display device (20) in order to
15   display an evaluation result in which the calculated value is included.

3.   The computer tomography unit as claimed in claim 2,
20 characterized in that the parameter describes spectral linearity or signal linearity of the radiation detector (4).

4.   The computer tomography unit as claimed in one of
25 claims 1 to 3, characterized in that the evaluation device (18) can compare the calculated value with a tolerance limit which can be predetermined or is read from a memory (21).

30 5.   The computer tomography unit as claimed in one of claims 1 to 4,
    characterized in that the evaluation result can be displayed graphically on the display device (20), in particular with two or more parameters being combined
35 to form a graphical pattern.

6.   The computer tomography unit as claimed in one of

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claims 1 to 5,
characterized by a memory device (22) for storage of the
evaluation result.

7. The computer tomography unit as claimed in one of claims 1 to 6,
characterized in that a further parameter can be determined which is suitable for assessment of the quality of the data acquisition system (10), of a component, of a module element or of a subarea of the data acquisition system (10).

8. The computer tomography unit as claimed in claim 7, characterized in that the parameter is suitable for assessment of an electronics channel which is associated with a detector element, in particular for assessment of an integrator (30a-30x) in the electronics channel, for assessment of a monitor channel, for assessment of a demultiplexer (31), or for assessment of an A/D converter (33).

9. The computer tomography unit as claimed in one of claims 1 to 6,
characterized in that a further parameter can be determined which is suitable for assessment of the data transmission path (11).

10. The computer tomography unit as claimed in one of claims 1 to 9,
characterized in that the evaluation device determines the value of the parameter statistically from the measured raw data.

11. The computer tomography unit as claimed in one of claims 1 to 10,
characterized in that the evaluation device is implemented by driving by means of appropriate software which, in particular, is provided in a computer (16), in particular in a control computer, which is fitted away from the gantry (7).

Patent Claims

1. A computer tomography unit having a radiation detector (4) which has a number of detector elements (6a-6x), having a data acquisition system (10) for reading the electrical signals which are produced by the detector elements (6a-6x) and for processing them to form raw data, and having an image computer (12) which is arranged downstream from the data acquisition system (10) and to which the raw data can be supplied via a data transmission path (11),
characterized by
an evaluation device (18) for automated assessment of the quality of the data acquisition system (10) and/or of the data transmission path (11).

2. The computer tomography unit as claimed in claim 1,
characterized in that the evaluation device (18) is additionally designed for automatic assessment of the quality of the radiation detector (4).

3. The computer tomography unit as claimed in claim 1 or 2,
characterized in that the following steps can be carried out by the evaluation device (18):
a) initiation of one or more measurements for production of raw data,
b) using the raw data, calculation of at least one value of at least one parameter which allows a quality statement,
c) driving of a display device (20) in order to display an evaluation result in which the calculated value is included.

4. The computer tomography unit as claimed in claim 3,

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characterized in that the evaluation device (18) can compare the calculated value with a tolerance limit which can be predetermined or is read from a memory 21.

5.   The computer tomography unit as claimed in claim 3
or 4,
characterized in that the evaluation result can be
displayed graphically on the display device (20), in
5   particular with two or more parameters being combined
to form a graphical pattern.

6.   The computer tomography unit as claimed in one of
claims 3 to 5,
10   characterized by
a memory device (22) for storage of the evaluation
result.

7.   The computer tomography unit as claimed in one of
15   claims 3 to 6,
characterized in that the parameter is suitable for
assessment of the quality of the data acquisition
system (10), of a component, of a module element or of
a subarea of the data acquisition system (10).
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8.   The computer tomography unit as claimed in
claim 7,
characterized in that the parameter is suitable for
assessment of an electronics channel which is
25   associated with a detector element, in particular for
assessment of an integrator (30a-30x) in the
electronics channels, for assessment of a monitor
channel, for assessment of a demultiplexer (31), or for
assessment of an A/D converter (33).
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9.   The computer tomography unit as claimed in one of
claims 3 to 6,
characterized in that
the parameter is suitable for assessment of the data
35   transmission path (11).

10.   The computer tomography unit as claimed in one of

claims 3 to 6,
characterized in that the parameter is suitable for
assessment of the quality of the radiation

detector (4), in particular for assessment of a single
detector element (6a-6x) in the radiation detector (4).

11. The computer tomography unit as claimed in
5   claim 10,
characterized in that
the parameter describes a signal offset.

12. The computer tomography unit as claimed in
10   claim 10,
characterized in that the parameter describes spectral
linearity or signal linearity.

13. The computer tomography unit as claimed in one of
15   claims 3 to 12,
characterized in that the evaluation device determines
the value of the parameter statistically from the
measured raw data.

20   14. The computer tomography unit as claimed in one of
claims 1 to 13,
characterized in that the evaluation device is
implemented by driving by means of appropriate software
which, in particular, is provided in a computer (16),
25   in particular in a control computer, which is fitted
away from the gantry (7).

Patentansprüche

1. Computertomographiegerät mit einer Röntgenstrahlenquelle
(1) und mit einem mehrere Detektorelemente (6a-6x) aufweisen-
5   den Strahlungsdetektor (4), mit einem Datenerfassungssystem
(10) zum Auslesen der von den Detektorelementen (6a-6x) er-
zeugten elektrischen Signale und deren Verarbeitung zu Rohda-
ten und mit einem dem Datenerfassungssystem (10) nachgeordne-
ten Bildrechner (12), welchem die Rohdaten über eine Daten-
10   übertragungsstrecke (11) zuführbar sind,
g e k e n n z e i c h n e t ,   d u r c h
eine Auswerteeinrichtung (18), die zur automatischen Beurtei-
lung der Qualität des Strahlungsdetektors (4) und zusätzlich
zur automatisierten Beurteilung der Qualität des Datenerfas-
15   sungssystems (10) und/ oder der Datenübertragungsstrecke (11)
hergerichtet ist, wobei von der Auswerteeinrichtung (18) fol-
gende Schritte durchführbar sind:
a) Auslösen wenigstens einer Messung zur Erzeugung von Rohda-
   ten bei abgeschalteter Röntgenstrahlenquelle (1),
20   b) unter Verwendung der Rohdaten Berechnung wenigstens eines
   Wertes eines Signal-Offsets des Strahlungsdetektors (4),
c) Ansteuerung einer Anzeigeeinrichtung (20) zur Darstellung
   eines Auswerteergebnisses, in das der berechnete Wert ein-
   fließt.

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2. Computertomographiegerät mit einer Röntgenstrahlenquelle
(1) und mit einem mehrere Detektorelemente (6a-6x) aufweisen-
den Strahlungsdetektor (4), mit einem Datenerfassungssystem
(10) zum Auslesen der von den Detektorelementen (6a-6x) er-
30   zeugten elektrischen Signale und deren Verarbeitung zu Rohda-
ten und mit einem dem Datenerfassungssystem (10) nachgeordne-
ten Bildrechner (12), welchem die Rohdaten über eine Daten-
übertragungsstrecke (11) zuführbar sind,
g e k e n n z e i c h n e t ,   d u r c h
35   eine Auswerteeinrichtung (18), die zur automatischen Beurtei-
lung der Qualität des Strahlungsdetektors (4) und zusätzlich
zur automatisierten Beurteilung der Qualität des Datenerfas-

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sungssystems (10) und/ oder der Datenübertragungsstrecke (11)
hergerichtet ist, wobei von der Auswerteeinrichtung (18) fol-
gende Schritte durchführbar sind:

a) Auslösen mehrerer Messungen zur Erzeugung von Rohdaten,
5   wobei zwischen wenigstens zwei Messungen selbsttätig eine
Änderung der Ansteuerung oder Einstellung der Röntgen-
strahlenquelle (1) vornehmbar ist,

b) unter Verwendung der Rohdaten Berechnung wenigstens eines
Wertes von mindestens einem eine Qualitätsaussage über den
10   Strahlungsdetektor (4) erlaubenden Parameter,

c) Ansteuerung einer Anzeigeeinrichtung (20) zur Darstellung
eines Auswerteergebnisses, in das der berechnete Wert ein-
fließt.

15   3. Computertomographiegerät nach Anspruch 2,
d a d u r c h   g e k e n n z e i c h n e t,   dass der Para-
meter eine spektrale Linearität oder eine Signallinearität
des Strahlungsdetektors (4) beschreibt.

20   4. Computertomographiegerät nach einem der Ansprüche 1 bis 3,
d a d u r c h   g e k e n n z e i c h n e t,   dass von der
Auswerteeinrichtung (18) ein Vergleich des berechneten Wertes
mit einer vorgebbaren oder aus einem Speicher (21) ausgelese-
nen Toleranzgrenze durchführbar ist.

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5. Computertomographiegerät nach einem der Ansprüche 1 bis 4,
d a d u r c h   g e k e n n z e i c h n e t,   dass das Aus-
werteergebnis grafisch auf der Anzeigeeinrichtung (20) dar-
stellbar ist, wobei insbesondere mehrere Parameter zu einem
30   grafischen Muster zusammengefasst sind.

6. Computertomographiegerät nach einem der Ansprüche 1 bis 5,
g e k e n n z e i c h n e t,   d u r c h
eine Speichereinrichtung (22) zum Abspeichern des Auswerteer-
35   gebnisses.

7. Computertomographiegerät nach einem der Ansprüche 1 bis 6, d a d u r c h   g e k e n n z e i c h n e t,   dass ein weiterer Parameter ermittelbar ist, der zur Beurteilung der Qualität des Datenerfassungssystems (10) oder einer Komponente,

5   eines Teilmoduls oder eines Teilbereichs des Datenerfassungssystems (10) geeignet ist.

8. Computertomographiegerät nach Anspruch 7, d a d u r c h   g e k e n n z e i c h n e t,   dass der Pa

10   rameter zur Beurteilung eines einem Detektorelement zugeordneten Elektronikkanals, insbesondere zur Beurteilung eines Integrators (30a-30x) des Elektronikkanals, zur Beurteilung eines Monitorkanals, zur Beurteilung eines Demultiplexers (31) oder zur Beurteilung eines A/D-Wandlers (33) geeignet

15   ist.

9. Computertomographiegerät nach einem der Ansprüche 1 bis 6, d a d u r c h   g e k e n n z e i c h n e t,   dass ein weiterer Parameter ermittelbar ist, der zur Beurteilung der Da

20   tenübertragungsstrecke (11) geeignet ist.

10. Computertomographiegerät nach einem der Ansprüche 1 bis 9, d a d u r c h   g e k e n n z e i c h n e t,   dass die Aus

25   werteeinrichtung den Wert des Parameters statistisch aus den gemessenen Rohdaten ermittelt.

11. Computertomographiegerät nach einem der Ansprüche 1 bis 10,

30   d u r c h   g e k e n n z e i c h n e t,   dass die Auswerteeinrichtung durch Ansteuerung mittels einer entsprechenden Software realisiert ist, die insbesondere in einem außerhalb der Gantry (7) angebrachten Computer (16), insbesondere in einem Steuerrechner, vorhanden ist.